LOUISVILLE ARENA AUTHORITY – KFC YUM! CENTER

TECHNICAL SPECIFICATIONS: LED DISPLAYS

PROJECT NUMBER:
KFC20-1626

02.17.2021

PART 1 GENERAL

1.1 INTRODUCTION

A. Louisville Arena Authority – KFC YUM! Center (hereinafter referred to as “the Owner”) intends to acquire a complete turnkey LED Display system. The Owner herewith requests proposals for the design, engineering, installation, commissioning, testing, and acceptance of the systems described in the attached specifications and forthcoming drawings for the interested persons (hereinafter known as “the Contractor”). Prices quoted shall be all-inclusive and represent complete installation at the site shown on the forthcoming drawings and in the attached specifications. The Contractor shall be responsible for all parts, labor, and all other associated apparatus necessary to completely install, test, and turn-over for acceptance to the Owner turnkey, fully operational system(s).

1.2 DESCRIPTION

A. The Contractor will provide a turn-key installation of the displays and control and scoring equipment, including all electrical and signal cable/conduit that is required. Contractor is required to provide the design based on their product offering and provide an engineered stamped drawing set as part of their proposal per section 3.2

B. The Contractor shall be responsible for the removal and disposal of all displays and equipment being replaced as part of the RFP.

C. The Contractor shall be responsible for the provision and installation of any primary and secondary steel, mounting brackets/hardware required. This includes all labor, materials, equipment; tools, transportation, and project management required for a complete and fully operational system(s).

D. Owner will provide primary electrical power for all displays in proximate locations to the displays. Contractor shall be responsible for all power and electrical distribution from demarcation point to the new system(s). Contractor shall provide all secondary power connections/terminations required to power new system(s). Contractor is responsible for providing stamped electrical drawings by a licensed electrical engineer in the state of Kentucky.

E. Owner will provide signal cable pathways/conduit as currently exists. All additional conduit and raceways required to complete a path to each display shall be furnished and installed by Contractor. Contractor shall be responsible to furnish, install, and terminate all required cabling needed to make new system(s) complete and fully operational.

F. A rendering package is provided as part of this bid package. The illustrations are to be construed as conceptual and not for construction purposes. Contractor shall be responsible for final engineering of the structural and electrical components required for new system(s), including professional engineering stamp by a licensed/registered engineer in the State of Kentucky.

G. Contractor is responsible for supplying a complete and fully operational system as intended by the RFP documents and any subsequent addendums. Prior to entering into a contract for the project, bidder is responsible for notifying Owner of any equipment omissions in the RFP documents that would prevent the completion of a fully operational system. If Contractor fails to notify Owner of any equipment omissions, Contractor shall assume responsibility for providing the required equipment at no additional cost to Owner.

H. Contractor shall field verify all work site conditions, including dimensions and site lines prior to submitting shop drawings.

I. The Contractor will be wholly responsible for any necessary logistic, staging, planning, etc. required to access and execute the work. This includes any demolition, clearing and put back necessary to access the project or to create staging or storage areas. Contactor shall return all existing conditions and improvements to a condition equal to the condition it was found upon mobilization.

J. Contractor shall grant Owner a license to use all proprietary software provided with this RFP for the life of the system.

1.3 BIDDER QUALIFICATIONS

A. Owner seeks to contract with a bidder for the full performance of the work as described in this RFP and to obtain long-term service and support for all equipment supplied by the selected bidder. In an effort to ensure the chosen bidder has the long-term interests of Owner in mind, the following shall be required in order to submit a bid for this project. Failure to submit acceptable responses to all of these requirements shall eliminate a bidder from consideration. The Owner, in its sole discretion, shall reserve the right to waive any or all of the requirements listed below.

1. Bidder shall provide a list of a minimum of five (5) facilities (facility, contact name, title, address and current phone number) where the bidder has provided equipment and services of equivalent brand, size and scope within the last 3 years.
2. Bidder shall provide a minimum of two (2) facility (facility, contact name, title, address and current phone number) where the bidder has provided equipment and services of equivalent brand, size and scope that is at least five (5) years old.
3. Bidder shall be required to provide a Letter of Surety from their bonding agent, stating their ability to provide a 100% payment and performance bond if they are the successful bidder.
4. Bidder shall have a direct service employee or certified contractor capable of providing maintenance response within 2 hours of a call for service.

1.4 SUBMITTAL REQUIREMENTS

A. Initial Submittals and Shop Drawings

1. Contractor shall be required to provide submittals and shop drawings to Owner within thirty (30) calendar days of date shown on award notice, acknowledged with a binding letter of intent. Contractor shall be responsible to ensure that the dimensions and specifications of each component and all systems fit within the building allowances. The Owner and AJP must review and approve all submittal documents prior to the start of work. Contractor shall advise the Owner of any discrepancy that could affect installation. If Contractor fails to notify Owner of any discrepancies, Contractor shall assume responsibility for providing the required equipment or correcting such discrepancies at no additional cost to Owner. The following required submittals will be defined by guidelines established by the Owner and shall include but not be limited to:
    a. Submit three sets of shop drawings, product data and samples together in one package within thirty (30) calendar days of date shown on award notice to Contract and prior to ordering equipment.
    b. Submit catalog data sheets, neatly bound with title page, space for submittal stamps, and tabbed dividers between Sections. Provide a complete list of proposed equipment with reference to its corresponding specification paragraph number or equipment title in specification paragraph order. Denote all approved substitutions.
    c. Submit fabrication shop drawings for all displays including component weight and power calculations.
    d. Submit structural engineered drawings for all primary and secondary steel framing required for this scope of work. Structural engineered drawings shall also include method of attachment for LED displays and all other signage elements required for this scope of work.
    e. Submit point-to-point wiring diagrams and typed wire lists identifying every connection. Include electronic devices such as switches, transformers, and terminal blocks. Indicate locations of all components. Identify cables by type, color, and wire numbers.
    f. Submit conduit riser diagrams showing required conduits and junction boxes along with types of quantities of cables to be contained in each conduit. Show details of weatherproofing, lightning protection and grounding, strain relief and cable support, fire stop protection, and wall penetrations through all rated partitions.
    g. Submit rack layouts indicating the proposed arrangement of mounted equipment including power junction box location. Rack layouts shall include front and rear views.
    h. Submit detail drawings of all custom fabricated items and approved equipment modifications. Include complete parts lists, schematic diagrams, and all dimensions required for proper assembly.
    i. LED population layout drawings shall be submitted for each backlit channel letter and/or signage element required under this scope of work. Photos, confirming LED lighting layout, shall be submitted for each backlit channel letter and/or signage element upon completion of fabrication and prior to shipping product to site.
    j. Submittal drawings shall indicate proposed color selections and finishes for all exposed surfaces and custom fabricated items. Submit actual color/finish samples, wall plates, and custom labels.
    k. Submit a list of all lower tier subcontractors and suppliers. List shall include lower tier subcontractor’s qualifications indicating performance of similar work on past projects of this type and scope.

l. Submit a project schedule in Gantt chart format outlining equipment delivery dates and installation start and finish dates. Project schedule shall be broken down into sufficient detail (work task and duration) to permit Owner to monitor installation progress on a daily basis.

m. Copies of all required business and contractor licenses.

n. Copies of proof of insurance.

o. Approval of submitted items indicates only the acceptance of the manufacturer and quality. Specific requirements, arrangements, and quantities shall comply with the intent of the Contract Documents as interpreted by the Owner unless specifically approved in writing.

p. Submittals that are incomplete, deviate significantly from the requirements of the Contract Documents, or contain numerous errors will be returned without review for rework and re-submittal, and may result in back charges to the contractor.

B. Contract Closeout Submittal

1. When the installation is substantially complete including the Testing Reports in Part 3 of this Section, Contractor shall submit two (2) complete initial hard copy sets of contract closeout submittals to the Owner for review. After review and approval of initial set, Owner shall return one (1) initial hard copy to Contractor with comments for updating. Contractor shall provide four (4) final sets of closeout submittals to Owner and one (1) electronic copy in PDF format. Closeout submittals shall include, but not be limited to:

a. Project Record Drawings (As-Built Drawings) including final screen fabrication drawings, secondary steel structural drawings, electrical drawings, system block diagrams, rack layout drawings, custom fabricated signage drawings (final fabrication version), and LED population and/or fluorescent lighting layout drawings for custom fabricated signage.

b. A list of all equipment provided and its location within the facility. List shall include manufacturer name, model identifier, serial number, and any other pertinent information needed to obtain service, maintenance, and/or replacement.

c. A list of all Subcontractors who performed work for Contractor during installation. List shall include company name, physical company address, phone number, and contact person(s).

d. Documentation certifying old video displays, matrix displays, signage elements and associated support structures that were demolished by Contractor prior to the installation of new equipment has been properly disposed of or recycled per local, provincial, and/or federal law(s).

e. Test reports from an independent testing & inspection agency certifying that bolted and/or welded connections for secondary structural steel meet the minimum requirements of the engineered structural drawings, the governing building code, or as required by the building official; whichever is more restrictive.

f. All testing reports as specified in Section 3.7 – Testing and Acceptance.

g. Test reports for all new fiber optic cable installed under this scope of work. Test reports shall indicate end to end signal loss does not exceed a maximum dB loss per Section 3.4.M and/or 3.4.N.

h. Operation & Maintenance Manual

Upon substantial completion and prior to on-site training with the Owner, Contractor shall provide four (4) final Operation & Maintenance Manuals (O&M Manuals). O&M Manuals shall have tab dividers and shall be logically organized to provide easy access to information without the need to research through entire manual. All documents provided in the O&M Manual shall be written in English and shall provide sufficient detail as to be understood by an individual with no knowledge of LED displays or the associated control equipment and/or operating systems. Contents of the O&M Manual shall include, but not be limited to:

1) Table of Contents

2) Description / overview of system(s) including key features and operational procedures.

3) Full start up procedure for all control room rack equipment and LED display equipment written under the assumption that all equipment was in full powered off mode.

4) Full shutdown procedure for all control room rack equipment and LED display equipment written under the assumption that the facility is in an extended power failure situation.

5) Procedure for switching to back up LED display processors and back up graphics/animation servers.

6) Troubleshooting procedures for all LED displays, LED display processors, graphics/animation servers, scoring systems, and all related equipment provided by Contractor. Troubleshooting procedures shall include demonstration photos and/or diagrams as required.

7) Maintenance procedures for all LED displays, LED display processors, graphics/animation servers, scoring systems, and all related equipment provided by Contractor. Maintenance procedures shall include demonstration photos and/or diagrams as required. Contractor shall indicate whether maintenance procedures should be performed monthly, bi-annually, or annually.

8) Owner's Manuals for all third party and/or "off-the-shelf" type equipment provided by Contractor: e.g., KVM's, fiber modems, network switches/routers, and UPS battery backups.

9) All third-party equipment and/or "off-the-shelf" equipment warranties and a notarized System Warranty.

1.5 EQUIPMENT GENERAL SPECIFICATIONS

A. All equipment and materials, except owner furnished, shall be new and the latest version at the time of bid and shall conform to applicable UL, ULC, CSA or ANSI provisions. Re-manufactured or "B" stock equipment will not be accepted without prior written consent from the Owner. Evidence of unauthorized re-manufactured or "B" stock equipment on the project site will be deemed evidence of the contractor's failure to perform the work. Contractor shall take care during installation to prevent scratches, dents, chips or disfiguration of equipment and materials supplied. All damaged equipment and/or materials shall be repaired or replaced at Owner's discretion. Contractor shall perform either option selected by Owner at no additional cost to the Owner.

B. Unless specified differently on the AJP Drawings, back lit channel letters and back lit fixed ad panels shall be illuminated as indicated below, which are the minimum acceptable product specifications. Contractor shall be responsible to ensure that the output of lighting is of sufficient lumens to clearly and successfully illuminate signage elements when used in the facility under event lighting conditions. Hot spots or dark spots shall not be acceptable. Consideration shall be given to match the Kelvin temperature when various combinations of illumination methods are used for different signage elements (i.e. LED illumination mixed with Fluorescent illumination).

1. LED Illumination

a. LED's shall be SloanLED V Series or approved equal. LED's shall be placed at a maximum of three (3) inches on center throughout the letter stroke or fixed ad cabinet.

b. Multiple rows of LED's shall start no more than three (3) inches from returns.

c. Electrical connections and/or electrical boxes shall not be visible to public view.

C. Cabinets for channel letters and back lit fixed ad panels shall appear from the exterior to be seamless construction. Seams shall be filled and sanded smooth prior to application of final finish color. Visible fasteners or mounting brackets shall not be acceptable. Light leaks around cabinet or between cabinet and letter face or fixed ad face shall not be acceptable.

D. All cabling [power and data] is to be labeled at each end of the cable with a description in English OR with a reference to a wire designation on a wiring diagram. This includes all cables internal to the displays, all cables between displays and control room, and all cables internal to the control room. These diagrams must be part of the Project documentation submitted to the Owner at time of acceptance.

E. Each device shall meet all of its published manufacturer's specifications. Verify performance as required.

F. Provide an uninterruptable power supply (UPS) at the bottom of each rack supplied by Contractor. UPS shall have the capability of providing power to all equipment within the rack for a period of 15 minutes in the event of a power failure at the facility.

G. Install all rack mounted equipment with Middle Atlantic Products HP Series truss head screws or approved equal.

H. Some rack-mounted equipment may require shaft locks, security covers, or removal of knobs; provide and install during Acceptance Testing.

I. Provide engraved self-adhesive phenolic labels at the fount and rear of all rack-mounted signal processing equipment. Mount labels on the equipment chassis and attach in a neat and permanent manner. Embossed label will not be accepted. Label equipment with schematic enumeration reference, and with descriptive information regarding its function or area it is serving. Similarly, provide engraved labels at the rear only of equipment mounted in furniture consoles.

J. All engraving shall be 1/8” block lettering unless noted otherwise. On dark panels or pushbuttons, letters shall be white. Letters shall be black on stainless steel, brushed natural aluminum plates or light-colored pushbuttons.

K. Per IEC-268 standard, all XLR connectors not mounted on equipment shall be wired pin 2 hot (high), pin 3 low, and pin 1 screen (shield).

L. Mounting Hardware exposed to the weather shall be aluminum, brass epoxy painted galvanized steel or stainless steel. Apply corrosion inhibitor to all threaded fittings.

M. Equipment Racks shall be Middle Atlantic Products model MRK-4436, or approved equal, with accessories as noted below. Quantity of racks shall be as required to house all equipment supplied under this scope of work. Any unused rack mounting spaces shall have blank panels to full enclose the rack assembly. Multiple racks shall be anchored together using appropriate ganging hardware. Standard solid rear door shall be replaced with Middle Atlantic Products model MW-VRD-44 vented rear door.

1. Provide two (2) side panels per individual stand-alone rack or series of racks ganged together. The intent is to have an enclosed rack system. A single stand-alone rack would have two (2) side panels and a series of three (3) racks ganged together would also have two (2) side panels. Side panels shall be Middle Atlantic Products model SPN-44-36 or approved equal.

2. Provide Middle Atlantic Products model MW-4QFT-FC integrated fan top, or approved equal, for each rack. Fan shall be thermostatically controlled to ensure in-rack temperatures of less than 100 degrees Fahrenheit.

3. Provide two (2) Middle Atlantic Products model LT-GN-PL gooseneck work light for each rack required for this scope of work.

4. Provide Middle Atlantic Products model PDT-2X1020T, or approved equal, in rack vertical power strip. Power strip shall have enough receptacles to accommodate all equipment housed in the associated rack with a minimum of two spare receptacles per rack.

N. Any rear mounted rack equipment shall be placed so the equipment does not block access to the back of front mounted equipment.

O. Contractor shall exercise care when wiring racks to avoid damaging cables and equipment. Contractor shall install grommets around cut-outs and knockouts where conduit or chase nipples are not installed.

P. Equipment Racks shall have a ground buss installed in each rack. Ground buss shall be insulated from the rack. Attach equipment rack to ground buss at one point using #4 insulated copper wire. Ground any equipment chassis without a three-conductor power cord directly to the buss bar using #12 insulated copper wire. Tie each and every power receptacle ground contact to the buss bar using #12 insulated copper wire. Interconnect signal cables shall be routed from junction boxes through metallic flexible conduit(s) (1” to 2” diameter) as appropriate. Flexible conduit shall be insulated from racks by approved insulating bushings.

Q. Power wiring and signal/data wiring shall be installed on opposite sides of rack. Contractor may determine which side is using for power and which side for signal. Method shall be kept the same for entire installation if multiple racks are required. Contractor shall exercise care when wiring racks to avoid damaging cables and equipment.

1.6 QUALITY ASSURANCE

A. All requirements of the latest published editions of the following standards shall apply, unless otherwise noted. In the event of conflict between cited or referenced standards, the more stringent shall govern.

1. National Electric Code (NEC).
2. National Electrical Manufacturers Association (NEMA)
3. American National Safety Institute (ANSI)
4. Occupational Safety and Health Administration (OSHA)
5. American Iron and Steel Institute (AISI)
6. Underwriters Laboratories (UL)
7. Federal Communications Commission (F.C.C.) Rules and Regulations, Part 76.

8. Society of Cable Television Engineers (S.C.T.E.)
9. Society of Motion Picture and Television Engineers (S.M.P.T.E.)
10. American Society of Testing Materials (A.S.T.M.)
11. National Cable Television Association (N.C.T.A)
12. Electronic Industries Association (E.I.A.)
13. Telecommunications Industries Association (T.I.A.)
14. Kentucky Building Code – Most Current Revision

B. Review all architectural, civil, structural, mechanical, electrical, and other project documents relative to this work.

C. Verify all dimensions and site conditions prior to starting work.

D. Coordinate the specified work with all other trades.

E. Maintain a competent supervisor and supporting technical personnel, acceptable to the Owner during the entire installation. Change of supervisor during the project shall not be permitted without prior written approval from the Owner.

F. Provide all items not indicated on the drawings or mentioned in the specifications that are necessary, required, or appropriate for this work to realize a complete and fully operational system that performs in stable and safe manner.

G. Review project documentation and continuously make known any conflicts discovered and provide all items necessary to complete this work to the satisfaction of the Owner without additional expense. In all cases where a device or item or equipment is referred to in singular number or without quantity, each such reference shall apply to as many such devices or items as are required to complete the work.

H. Provide additional support or positioning members as required for the proper installation and operation of equipment, materials and devices provided as part of this work as approved by the Owner, without additional cost to the Owner.

I. Regularly examine all construction, and the work of others, which may affect Contractors work to ensure proper conditions exist at site for the equipment and devices before their manufacture, fabrication, or installation. Contractor shall be responsible for the proper fitting of the systems, equipment, materials, and devices provided as part of this work.

J. Promptly notify the Owner in writing of any difficulties that may prevent proper coordination or timely completion of this work. Failure to do so shall constitute acceptance of construction as suitable in all ways to receive this work, except for defects that may develop in the work of others after its execution.

K. After installation, submit photographs showing cable entries and terminations within equipment racks, enclosures, and pedestals at the job site.

1.7 WARRANTY AND SERVICE

A. Contractor shall warrant labor and materials for twenty-four (24) months following the date of Final Acceptance.

B. During the warranty period the system shall be free of defects and deficiencies and conform to the drawings and specifications with respect to the quality, function, and characteristics stated.

C. Contractor shall repair or replace defects that occur in labor or materials within the warranty period. If repair is affected using Owners spare parts allotment, Contractor shall replenish all parts used to keep Owner’s inventory at the amount required by the contract.

D. On-site labor shall be included during the warranty period for any work beyond simple component replacement. Simple component replacement shall be defined as lighting unit or power supply replacement or the replacement of an internal display signal cable that does not require tools to perform the cable replacement.

E. Failed parts shall be returned to the Contractor for repair at a service facility located in the United States. Contractor shall identify the location of its service facility in the documentation provided when submitting a bid for this work.

F. The Contractor shall replace failed parts that cannot be repaired.

G. Upon receipt of a failed part, Contractor shall return a repaired or replacement part to the Owner within fifteen (15) business days from receipt of failed part.

H. Contractor shall supply at least one local service employee or local authorized service agent for servicing and repair of all equipment during the warranty period. Local service employee or local authorized service agent shall be located within 75 miles of Owner's facility.

I. The local service employee or local authorized service agent shall be entity responsible for providing the following emergency response availability:

1. Telephone service assistance and technical support from 8am to 11pm local time at Owner's facility, 7-days per week.

2. Answer all service calls and requests for information within one (1) hour during the warranty period and provide on-site repair service within 24 hours.

3. A parts exchange program, including same day shipment of exchange parts. The manufacturer shall keep a ready stock of key assemblies available to ship out upon notice of a parts failure if part is not available in spare parts inventory at Owner's facility.

4. The advance replacement should contain all of the shipping information and packaging necessary to return the defective part or assembly back to Contractor at no cost to the Owner.

J. Warranty shall cover all equipment, including processors, controllers, operating systems, and software.

K. Warranty shall include two annual on-site system check-ups by a qualified technician who is a full-time employee of the Contractor. Visit to occur approximately 2-3 weeks prior to the start of the second and third seasons or as determined by Owner.

L. Check-up shall include all regular maintenance; including filter changes, a complete inspection of all systems, brightness level readings of LED displays, parts replacement where required and a complete written report of all findings.

M. All extended warranty pricing requested in this RFP shall include the same requirements as stated in this section unless specifically excluded on the bid form.

N. In addition to the base warranty, Contractor will provide a guarantee against systemic parts failures for a period of seven years from final acceptance. A systemic parts failure is defined as a failure of more than 5% of a particular part or component in a display, over a 12-month period. If it is determined that a systemic parts failure has occurred, Contractor will be responsible for all costs to remedy the problem to the satisfaction of the Owner.

O. Furthermore, if a particular system problem that resolves without a repair, presents itself in more than 2 consecutive events, Contractor will be responsible for providing on-site event support as well as system diagnosis, until the problem is identified and resolved. Some examples of this would be a signal flash, flickering, module(s) outage.

1.8 SPARE PARTS

A. Contractor shall supply a spare parts inventory containing 2% spare lighting units, 2% spare power supplies, and a minimum of one (1) of every other critical component including fiber modems. Spare parts inventory shall be based on quantity of components used to manufacture the display(s). Contractor shall provide proposed spare parts inventory as part of the bid submission.

B. At the time of final sign-off, Contractor shall supply the specified spare parts inventory regardless of spare parts used during initial "shake out", "burn in" and/or testing of newly installed displays.

C. Manufacturer of the LED system components shall continue to make all parts necessary for the continued functioning of the system for a minimum of seven (7) years after acceptance of this project. Furthermore, upon end of life of any component used in the LED displays, that is not replaced by a "backwards compatible" component, Manufacturer shall notify Owner of end of life status being given to components of this system, and shall give Owner an opportunity to buy spare parts from stock or a last production run, at then commercially viable prices.

END OF PART 1 GENERAL

PART 2 PRODUCTS

2.1 CENTER HUNG LED VIDEO DISPLAYS

A. Quantity: Four (4) Indoor HDR Video Displays

B. Pixel Resolution: 4mm physical pixel resolution.

C. LED Supplier: Only Nichia or Cree LED's will be accepted.

D. Minimum Active Area of Displays: Sideline displays 21.8' tall x 42.5' wide, Endzone displays 21.8' tall by 25.1' wide.

E. Minimum Resolution: Sideline displays 1664 x 3232, Endzone displays 1664 x 1920 based on maximum pixel pitch of 4mm.

F. Minimum Brightness: 2000nits (100% white with automatic color-correction "on") at startup.

G. System must maintain a minimum brightness level of 1500 nits throughout the first 10,000 hours of use or 36 months from the time of acceptance, whichever is longer.

H. Display's intensity shall be adjustable to a minimum of 256 levels.

I. Minimum 4,096 levels of intensity for each color (red, blue, pure green) 14-bit processing.

J. 4,500°-9,000° Kelvin color temperature. Color temperature shall remain constant across specified horizontal and vertical viewing angles.

K. Refresh rate shall be greater than 2,000+Hz.

L. Video frame rate at or greater than 60 frames per second.

M. Contrast ratio shall be greater than 1200:1.

N. IP rating shall be no less than 65 front and 54 rear.

O. Service accessibility for all components of the displays shall be from the front.

P. Pixel to Pixel Variation

1. 95% or more of pixels within each module must have a luminance within +/- 4% of the mean luminance for the module.
2. The average luminance of a column or row of pixels at the edge of a module or panel must be within +/- 2% of the average luminance of the module or panel.
3. 95% or more of the pixels within each module must have a chromaticity value, Δu'v', within +/- 0.006 of the mean chromaticity value for the module.

Q. Module to Module Variation

1. 100% of the modules in a screen must have a luminance within +/- 4% of the mean luminance for the screen.
2. 100% of the adjacent modules (i.e., modules sharing a border) in a screen must have a luminance within +/- 3% of each other.
3. 100% of the modules in a screen must have a chromaticity value, Δu'v', within +/- 0.006 of the mean chromaticity value for the screen.
4. 100% of the adjacent modules in a screen must have a chromaticity value, Δu'v', within +/- 0.003 of each other.

R. All uniformity specifications above apply across all specified minimum horizontal and vertical viewing angles and are to be met for an all White, all Red, all Green, and all Blue screen display.

S. All listed specifications must be maintained throughout the first 10,000 hours of use or 36 months from the time of acceptance, whichever is longer.

T. Minimum of a 140° (±70°) horizontal viewing angle. Defined at 50% of full intensity, with automatic color-correction "on", at stated angle maximum.

U. Minimum of a 140° (±70°) vertical viewing angle. Defined at 50% of full intensity, with automatic color-correction "on", at stated angle maximum.

2.2 CENTER HUNG UNDERBELLY DISPLAYS

A. Quantity: Two (2) Indoor HDR Video Displays

B. Pixel Resolution: 2.5mm physical pixel resolution.

C. LED Supplier: Only Nichia or Cree LED's will be accepted.

D. Minimum Active Area of Displays: 9.1' tall x 38.1' wide.

E. Minimum Resolution: 1104 x 4640 based on maximum pixel pitch of 2.5mm.

F. Minimum Brightness: 2000nits (100% white with automatic color-correction "on") at startup.

G. System must maintain a minimum brightness level of 1500 nits throughout the first 10,000 hours of use or 36 months from the time of acceptance, whichever is longer.

H. Display's intensity shall be adjustable to a minimum of 256 levels.

I. Minimum 4,096 levels of intensity for each color (red, blue, pure green) 14-bit processing.

J. 4,500°-9,000° Kelvin color temperature. Color temperature shall remain constant across specified horizontal and vertical viewing angles.

K. Refresh rate shall be greater than 2,000+Hz.

L. Video frame rate at or greater than 60 frames per second.

M. Contrast ratio shall be greater than 1200:1.

N. IP rating shall be no less than 65 front and 54 rear.

O. Service accessibility for all components of the displays shall be from the front.

P. Pixel to Pixel Variation

1. 95% or more of pixels within each module must have a luminance within +/- 4% of the mean luminance for the module.
2. The average luminance of a column or row of pixels at the edge of a module or panel must be within +/- 2% of the average luminance of the module or panel.
3. 95% or more of the pixels within each module must have a chromaticity value, Δu'v', within +/- 0.006 of the mean chromaticity value for the module.

Q. Module to Module Variation

1. 100% of the modules in a screen must have a luminance within +/- 4% of the mean luminance for the screen.
2. 100% of the adjacent modules (i.e., modules sharing a border) in a screen must have a luminance within +/- 3% of each other.
3. 100% of the modules in a screen must have a chromaticity value, Δu'v', within +/- 0.006 of the mean chromaticity value for the screen.
4. 100% of the adjacent modules in a screen must have a chromaticity value, Δu'v', within +/- 0.003 of each other.

R. All uniformity specifications above apply across all specified minimum horizontal and vertical viewing angles and are to be met for an all White, all Red, all Green, and all Blue screen display.

S. All listed specifications must be maintained throughout the first 10,000 hours of use or 36 months from the time of acceptance, whichever is longer.

T. Minimum of a 140° (±70°) horizontal viewing angle. Defined at 50% of full intensity, with automatic color-correction "on", at stated angle maximum.

U. Minimum of a 140° (±70°) vertical viewing angle. Defined at 50% of full intensity, with automatic color-correction "on", at stated angle maximum.

2.3 CENTER HUNG LED DISPLAYS – PROCESSING AND CONTROLS

A. Video screen control system must provide the ability to manage brightness (multi-level), video input, image position: size and scale, adjustable gamma correction, remote power function (power on/off), color, color temperature, contrast and sharpness.

B. Processing to allow for electronic color and brightness calibration - block to block and pixel to pixel.

C. The processor shall support the following inputs: 1080P-HDR, 1080P, HD-SDI video in either 720p or 1080i, SD-SDI (480p) and SDI 16x9 anamorphic signal, and DVI video.

D. Contractor is responsible for providing all required components, racks and wiring necessary to manage and control the video display from a location outside of the display housing.

E. System architecture must allow for 100% processing and control redundancy. Back up units shall be installed in the equipment racks and shall be hot swappable.

2.4 CENTER HUNG LED DISPLAYS – OPERATING SYSTEM

A. Provide a fully functional operating system capable of CG, exposure time tracking, and game operation. Systems must be capable of playing back industry standard still and animation file formats. File conversion is acceptable.

B. The system must have the ability to support DVE moves, enabling dynamic switching between full screen and vectored views with areas for sponsor ads, statistics, and game in progress data for the scoring system.

C. The system must be capable of accepting a serial feed from the scoring controller and any and all 3rd party stats, sport ticker feeds, social media feeds and closed captioning as required.

D. Image playback is to be stutter-free for both static and animated graphics.

E. Contractor is responsible for providing all required components, racks and wiring necessary to manage and control the LED display from a location outside of the display housing.

F. System architecture must allow for 100% processing and control redundancy. Back up units shall be installed in the equipment racks and shall be hot swappable.

2.5 SUSPENDED CORNER DISPLAYS

A. Quantity: Four (4) Indoor Video Display

B. Pixel Resolution: 6mm physical pixel resolution.

C. LED Supplier: Only Nichia or Cree LED’s will be accepted.

D. Minimum Active Area of Displays: 9.56’ tall by 56.8’ wide

E. Minimum Resolution: 480 x 2880 based on maximum pixel pitch of 6mm.

F. Minimum Brightness: 2000nits (100% white with automatic color-correction “on”) at startup.

G. System must maintain a minimum brightness level of 1500 nits throughout the first 10,000 hours of use or 36 months from the time of acceptance, whichever is longer.

H. Display’s intensity shall be adjustable to a minimum of 256 levels.

I. Minimum 4,096 levels of intensity for each color (red, blue, pure green) 14-bit processing.

J. 4,500°-9,000° Kelvin color temperature. Color temperature shall remain constant across specified horizontal and vertical viewing angles.

K. Refresh rate shall be greater than 2,000+Hz.

L. Video frame rate at or greater than 60 frames per second.

M. Contrast ratio shall be greater than 1200:1.

N. IP rating shall be no less than 65 front and 54 rear.

O. Service accessibility for all components of the displays shall be from the front.

P. Pixel to Pixel Variation

1. 95% or more of pixels within each module must have a luminance within +/- 4% of the mean luminance for the module.

2. The average luminance of a column or row of pixels at the edge of a module or panel must be within +/- 2% of the average luminance of the module or panel.

3. 95% or more of the pixels within each module must have a chromaticity value, Δu'v', within +/- 0.006 of the mean chromaticity value for the module.

Q. Module to Module Variation

1. 100% of the modules in a screen must have a luminance within +/- 4% of the mean luminance for the screen.

2. 100% of the adjacent modules (i.e., modules sharing a border) in a screen must have a luminance within +/- 3% of each other.

3. 100% of the modules in a screen must have a chromaticity value, Δu'v', within +/- 0.006 of the mean chromaticity value for the screen.

4. 100% of the adjacent modules in a screen must have a chromaticity value, Δu'v', within +/- 0.003 of each other.

R. All uniformity specifications above apply across all specified minimum horizontal and vertical viewing angles and are to be met for an all White, all Red, all Green, and all Blue screen display.

S. All listed specifications must be maintained throughout the first 10,000 hours of use or 36 months from the time of acceptance, whichever is longer.

T. Minimum of a 140° (±70°) horizontal viewing angle. Defined at 50% of full intensity, with automatic color-correction "on", at stated angle maximum.

U. Minimum of a 140° (±70°) vertical viewing angle. Defined at 50% of full intensity, with automatic color-correction "on", at stated angle maximum.

2.6 UPPER LEVEL RIBBON DISPLAYS

A. Quantity: One (1) Indoor Video Display

B. Pixel Resolution: 10mm physical pixel resolution.

C. LED Supplier: Only Nichia or Cree LED's will be accepted.

D. Minimum Active Area of Displays: 3.1' tall by 976' wide.

E. Minimum Resolution: 96 x 29,760 wide based on maximum pixel pitch of 10mm.

F. Minimum Brightness: 2000nits (100% white with automatic color-correction "on") at startup.

G. System must maintain a minimum brightness level of 1500 nits throughout the first 10,000 hours of use or 36 months from the time of acceptance, whichever is longer.

H. Display's intensity shall be adjustable to a minimum of 256 levels.

I. Minimum 4,096 levels of intensity for each color (red, blue, pure green) 14-bit processing.

J. 4,500°-9,000° Kelvin color temperature. Color temperature shall remain constant across specified horizontal and vertical viewing angles.

K. Refresh rate shall be greater than 2,000+Hz.

L. Video frame rate at or greater than 60 frames per second.

M. Contrast ratio shall be greater than 1200:1.

N. IP rating shall be no less than 65 front and 54 rear.

O. Service accessibility for all components of the displays shall be from the top.

P. Pixel to Pixel Variation

1. 95% or more of pixels within each module must have a luminance within +/- 4% of the mean luminance for the module.

2. The average luminance of a column or row of pixels at the edge of a module or panel must be within +/- 2% of the average luminance of the module or panel.

3. 95% or more of the pixels within each module must have a chromaticity value, Δu'v', within +/- 0.006 of the mean chromaticity value for the module.

Q. Module to Module Variation

1. 100% of the modules in a screen must have a luminance within +/- 4% of the mean luminance for the screen.
2. 100% of the adjacent modules (i.e., modules sharing a border) in a screen must have a luminance within +/- 3% of each other.
3. 100% of the modules in a screen must have a chromaticity value, Δu'v', within +/- 0.006 of the mean chromaticity value for the screen.
4. 100% of the adjacent modules in a screen must have a chromaticity value, Δu'v', within +/- 0.003 of each other.

R. All uniformity specifications above apply across all specified minimum horizontal and vertical viewing angles and are to be met for an all White, all Red, all Green, and all Blue screen display.

S. All listed specifications must be maintained throughout the first 10,000 hours of use or 36 months from the time of acceptance, whichever is longer.

T. Minimum of a 140° (±70°) horizontal viewing angle. Defined at 50% of full intensity, with automatic color-correction "on", at stated angle maximum.

U. Minimum of a 140° (±70°) vertical viewing angle. Defined at 50% of full intensity, with automatic color- correction "on", at stated angle maximum.

2.7 CLUB SIDELINE RIBBON DISPLAY

A. Quantity: Two (2) Indoor Video Displays

B. Pixel Resolution: 10mm physical pixel resolution.

C. LED Supplier: Only Nichia or Cree LED's will be accepted.

D. Minimum Active Area of Displays: 3.1' tall by 269' wide.

E. Minimum Resolution: 96 x 8224 based on maximum pixel pitch of 10mm.

F. Minimum Brightness: 2000nits (100% white with automatic color-correction "on") at startup.

G. Displays to include mounting hardware and padding.

H. System must maintain a minimum brightness level of 1500 nits throughout the first 10,000 hours of use or 36 months from the time of acceptance, whichever is longer.

I. Display's intensity shall be adjustable to a minimum of 256 levels.

J. Minimum 4,096 levels of intensity for each color (red, blue, pure green) 14-bit processing.

K. 4,500°-9,000° Kelvin color temperature. Color temperature shall remain constant across specified horizontal and vertical viewing angles.

L. Refresh rate shall be greater than 2,000+Hz.

M. Video frame rate at or greater than 60 frames per second.

N. Contrast ratio shall be greater than 1200:1.

O. IP rating shall be no less than 65 front and 54 rear.

P. Service accessibility for all components of the displays shall be from the top.

Q. Pixel to Pixel Variation

1. 95% or more of pixels within each module must have a luminance within +/- 4% of the mean luminance for the module.
2. The average luminance of a column or row of pixels at the edge of a module or panel must be within +/- 2% of the average luminance of the module or panel.
3. 95% or more of the pixels within each module must have a chromaticity value, Δu'v', within +/- 0.006 of the mean chromaticity value for the module.

R. Module to Module Variation

1. 100% of the modules in a screen must have a luminance within +/- 4% of the mean luminance for the screen.
2. 100% of the adjacent modules (i.e., modules sharing a border) in a screen must have a luminance within +/- 3% of each other.
3. 100% of the modules in a screen must have a chromaticity value, Δu'v', within +/- 0.006 of the mean chromaticity value for the screen.
4. 100% of the adjacent modules in a screen must have a chromaticity value, Δu'v', within +/- 0.003 of each other.

S. All uniformity specifications above apply across all specified minimum horizontal and vertical viewing angles and are to be met for an all White, all Red, all Green, and all Blue screen display.

T. All listed specifications must be maintained throughout the first 10,000 hours of use or 36 months from the time of acceptance, whichever is longer.

U. Minimum of a 140° (±70°) horizontal viewing angle. Defined at 50% of full intensity, with automatic color-correction "on", at stated angle maximum.

V. Minimum of a 140° (±70°) vertical viewing angle. Defined at 50% of full intensity, with automatic color- correction "on", at stated angle maximum.

2.8 ENDZONE RIBBON DISPLAYS

A. Quantity: Two (2) Indoor Video Displays

B. Pixel Resolution: 10mm physical pixel resolution.

C. LED Supplier: Only Nichia and Cree LED's will be accepted.

D. Minimum Active Area of Displays: 3.1' tall by 185' wide.

E. Minimum Resolution: 96 x 5664 based on maximum pixel pitch of 10mm.

F. Minimum Brightness: 2000nits (100% white with automatic color-correction "on") at startup.

G. System must maintain a minimum brightness level of 1500 nits throughout the first 10,000 hours of use or 36 months from the time of acceptance, whichever is longer.

H. Display's intensity shall be adjustable to a minimum of 256 levels.

I. Minimum 4,096 levels of intensity for each color (red, blue, pure green) 14-bit processing.

J. 4,500°-9,000° Kelvin color temperature. Color temperature shall remain constant across specified horizontal and vertical viewing angles.

K. Refresh rate shall be greater than 2,000+Hz.

L. Video frame rate at or greater than 60 frames per second.

M. Contrast ratio shall be greater than 1200:1.

N. IP rating shall be no less than 65 front and 54 rear.

O. Service accessibility for all components of the displays shall be from the top.

P. Pixel to Pixel Variation

1. 95% or more of pixels within each module must have a luminance within +/- 4% of the mean luminance for the module.
2. The average luminance of a column or row of pixels at the edge of a module or panel must be within +/- 2% of the average luminance of the module or panel.
3. 95% or more of the pixels within each module must have a chromaticity value, Δu'v', within +/- 0.006 of the mean chromaticity value for the module.

Q. Module to Module Variation

1. 100% of the modules in a screen must have a luminance within +/- 4% of the mean luminance for the screen.

2. 100% of the adjacent modules (i.e., modules sharing a border) in a screen must have a luminance within +/- 3% of each other.
3. 100% of the modules in a screen must have a chromaticity value, Δu'v', within +/- 0.006 of the mean chromaticity value for the screen.
4. 100% of the adjacent modules in a screen must have a chromaticity value, Δu'v', within +/- 0.003 of each other.

R. All uniformity specifications above apply across all specified minimum horizontal and vertical viewing angles and are to be met for an all White, all Red, all Green, and all Blue screen display.

S. All listed specifications must be maintained throughout the first 10,000 hours of use or 36 months from the time of acceptance, whichever is longer.

T. Minimum of a 140° (±70°) horizontal viewing angle. Defined at 50% of full intensity, with automatic color-correction "on", at stated angle maximum.

U. Minimum of a 140° (±70°) vertical viewing angle. Defined at 50% of full intensity, with automatic color- correction "on", at stated angle maximum.

2.9 EVENT LEVEL – CORNER RIBBON DISPLAYS

A. Quantity: Four (4) Indoor Video Displays

B. Pixel Resolution: 10mm physical pixel resolution.

C. LED Supplier: Only Nichia or Cree LED's will be accepted.

D. Minimum Active Area of Displays: 3.1' tall by 16.8' wide.

E. Minimum Resolution: 96 x 512 based on maximum pixel pitch of 10mm.

F. Minimum Brightness: 2000nits (100% white with automatic color-correction "on") at startup.

G. System must maintain a minimum brightness level of 1500 nits throughout the first 10,000 hours of use or 36 months from the time of acceptance, whichever is longer.

H. Display's intensity shall be adjustable to a minimum of 256 levels.

I. Minimum 4,096 levels of intensity for each color (red, blue, pure green) 14-bit processing.

J. 4,500°-9,000° Kelvin color temperature. Color temperature shall remain constant across specified horizontal and vertical viewing angles.

K. Refresh rate shall be greater than 2,000+Hz.

L. Video frame rate at or greater than 60 frames per second.

M. Contrast ratio shall be greater than 1200:1.

N. IP rating shall be no less than 65 front and 54 rear.

O. Service accessibility for all components of the displays shall be from the top.

P. Pixel to Pixel Variation

1. 95% or more of pixels within each module must have a luminance within +/- 4% of the mean luminance for the module.
2. The average luminance of a column or row of pixels at the edge of a module or panel must be within +/- 2% of the average luminance of the module or panel.
3. 95% or more of the pixels within each module must have a chromaticity value, Δu'v', within +/- 0.006 of the mean chromaticity value for the module.

Q. Module to Module Variation

1. 100% of the modules in a screen must have a luminance within +/- 4% of the mean luminance for the screen.
2. 100% of the adjacent modules (i.e., modules sharing a border) in a screen must have a luminance within +/- 3% of each other.

3. 100% of the modules in a screen must have a chromaticity value, Δu'v', within +/- 0.006 of the mean chromaticity value for the screen.
4. 100% of the adjacent modules in a screen must have a chromaticity value, Δu'v', within +/- 0.003 of each other.

R. All uniformity specifications above apply across all specified minimum horizontal and vertical viewing angles and are to be met for an all White, all Red, all Green, and all Blue screen display.

S. All listed specifications must be maintained throughout the first 10,000 hours of use or 36 months from the time of acceptance, whichever is longer.

T. Minimum of a 140° (±70°) horizontal viewing angle. Defined at 50% of full intensity, with automatic color-correction "on", at stated angle maximum.

U. Minimum of a 140° (±70°) vertical viewing angle. Defined at 50% of full intensity, with automatic color- correction "on", at stated angle maximum.

2.10 UPPER VOMITORY RIBBON DISPLAYS

A. Quantity: Thirty (30) Indoor Video Displays

B. Pixel Resolution: 10mm physical pixel resolution.

C. LED Supplier: Only Nichia or Cree LED's will be accepted.

D. Minimum Active Area of Displays: 3.1' tall by 9.5' wide.

E. Minimum Resolution: 96 x 288 based on maximum pixel pitch of 10mm.

F. Minimum Brightness: 2000nits (100% white with automatic color-correction "on") at startup.

G. System must maintain a minimum brightness level of 1500 nits throughout the first 10,000 hours of use or 36 months from the time of acceptance, whichever is longer.

H. Display's intensity shall be adjustable to a minimum of 256 levels.

I. Minimum 4,096 levels of intensity for each color (red, blue, pure green) 14-bit processing.

J. 4,500°-9,000° Kelvin color temperature. Color temperature shall remain constant across specified horizontal and vertical viewing angles.

K. Refresh rate shall be greater than 2,000+Hz.

L. Video frame rate at or greater than 60 frames per second.

M. Contrast ratio shall be greater than 1200:1.

N. IP rating shall be no less than 65 front and 54 rear.

O. Service accessibility for all components of the displays shall be from the top.

P. Pixel to Pixel Variation

4. 95% or more of pixels within each module must have a luminance within +/- 4% of the mean luminance for the module.
5. The average luminance of a column or row of pixels at the edge of a module or panel must be within +/- 2% of the average luminance of the module or panel.
6. 95% or more of the pixels within each module must have a chromaticity value, Δu'v', within +/- 0.006 of the mean chromaticity value for the module.

Q. Module to Module Variation

5. 100% of the modules in a screen must have a luminance within +/- 4% of the mean luminance for the screen.
6. 100% of the adjacent modules (i.e., modules sharing a border) in a screen must have a luminance within +/- 3% of each other.
7. 100% of the modules in a screen must have a chromaticity value, Δu'v', within +/- 0.006 of the mean chromaticity value for the screen.

8. 100% of the adjacent modules in a screen must have a chromaticity value, Δu'v', within +/- 0.003 of each other.

R. All uniformity specifications above apply across all specified minimum horizontal and vertical viewing angles and are to be met for an all White, all Red, all Green, and all Blue screen display.

S. All listed specifications must be maintained throughout the first 10,000 hours of use or 36 months from the time of acceptance, whichever is longer.

T. Minimum of a 140° (±70°) horizontal viewing angle. Defined at 50% of full intensity, with automatic color-correction "on", at stated angle maximum.

U. Minimum of a 140° (±70°) vertical viewing angle. Defined at 50% of full intensity, with automatic color- correction "on", at stated angle maximum.

2.11 LOWER VOMITORY RIBBON DISPLAYS

A. Quantity: Eight (8) Indoor Video Displays

B. Pixel Resolution: 10mm physical pixel resolution.

C. LED Supplier: Only Nichia or Cree LED's will be accepted.

D. Minimum Active Area of Displays: 3.1' tall by 4.1' wide.

E. Minimum Resolution: 96 x 128 based on maximum pixel pitch of 10mm.

F. Minimum Brightness: 2000nits (100% white with automatic color-correction "on") at startup.

G. System must maintain a minimum brightness level of 1500 nits throughout the first 10,000 hours of use or 36 months from the time of acceptance, whichever is longer.

H. Display's intensity shall be adjustable to a minimum of 256 levels.

I. Minimum 4,096 levels of intensity for each color (red, blue, pure green) 14-bit processing.

J. 4,500°-9,000° Kelvin color temperature. Color temperature shall remain constant across specified horizontal and vertical viewing angles.

K. Refresh rate shall be greater than 2,000+Hz.

L. Video frame rate at or greater than 60 frames per second.

M. Contrast ratio shall be greater than 1200:1.

N. IP rating shall be no less than 65 front and 54 rear.

O. Service accessibility for all components of the displays shall be from the top.

P. Pixel to Pixel Variation

7. 95% or more of pixels within each module must have a luminance within +/- 4% of the mean luminance for the module.

8. The average luminance of a column or row of pixels at the edge of a module or panel must be within +/- 2% of the average luminance of the module or panel.

9. 95% or more of the pixels within each module must have a chromaticity value, Δu'v', within +/- 0.006 of the mean chromaticity value for the module.

Q. Module to Module Variation

9. 100% of the modules in a screen must have a luminance within +/- 4% of the mean luminance for the screen.

10. 100% of the adjacent modules (i.e., modules sharing a border) in a screen must have a luminance within +/- 3% of each other.

11. 100% of the modules in a screen must have a chromaticity value, Δu'v', within +/- 0.006 of the mean chromaticity value for the screen.

12. 100% of the adjacent modules in a screen must have a chromaticity value, Δu'v', within +/- 0.003 of each other.

R. All uniformity specifications above apply across all specified minimum horizontal and vertical viewing angles and are to be met for an all White, all Red, all Green, and all Blue screen display.

S. All listed specifications must be maintained throughout the first 10,000 hours of use or 36 months from the time of acceptance, whichever is longer.

T. Minimum of a 140° (±70°) horizontal viewing angle. Defined at 50% of full intensity, with automatic color-correction “on”, at stated angle maximum.

U. Minimum of a 140° (±70°) vertical viewing angle. Defined at 50% of full intensity, with automatic color- correction “on”, at stated angle maximum.

2.12 EXTERIOR MARQUEE DISPLAY

A. Quantity: One (1) Outdoor Video Display

B. Pixel Resolution: 10mm physical pixel resolution.

C. LED Supplier: Only Nichia or Cree LED’s will be accepted.

D. Minimum Active Area of Displays: 21.5’ tall by 31.7’ wide.

E. Minimum Resolution: 640 x 960 based on maximum pixel pitch of 10mm.

F. Minimum Brightness: 7500nits (100% white with automatic color-correction “on”) at startup.

G. System must maintain a minimum brightness level of 7000 nits throughout the first 10,000 hours of use or 36 months from the time of acceptance, whichever is longer.

H. Display’s intensity shall be adjustable to a minimum of 256 levels.

I. Minimum 4,096 levels of intensity for each color (red, blue, pure green) 14-bit processing.

J. 4,500°-9,000° Kelvin color temperature. Color temperature shall remain constant across specified horizontal and vertical viewing angles.

K. Refresh rate shall be greater than 2,000+Hz.

L. Video frame rate at or greater than 60 frames per second.

M. Contrast ratio shall be greater than 1200:1.

N. IP rating shall be no less than 65 front and 54 rear.

O. Service accessibility for all components of the displays shall be from the front.

P. Pixel to Pixel Variation

10. 95% or more of pixels within each module must have a luminance within +/- 4% of the mean luminance for the module.

11. The average luminance of a column or row of pixels at the edge of a module or panel must be within +/- 2% of the average luminance of the module or panel.

12. 95% or more of the pixels within each module must have a chromaticity value, Δu’v’, within +/- 0.006 of the mean chromaticity value for the module.

Q. Module to Module Variation

13. 100% of the modules in a screen must have a luminance within +/- 4% of the mean luminance for the screen.

14. 100% of the adjacent modules (i.e., modules sharing a border) in a screen must have a luminance within +/- 3% of each other.

15. 100% of the modules in a screen must have a chromaticity value, Δu’v’, within +/- 0.006 of the mean chromaticity value for the screen.

16. 100% of the adjacent modules in a screen must have a chromaticity value, Δu’v’, within +/- 0.003 of each other.

R. All uniformity specifications above apply across all specified minimum horizontal and vertical viewing angles and are to be met for an all White, all Red, all Green, and all Blue screen display.

S. All listed specifications must be maintained throughout the first 10,000 hours of use or 36 months from the time of acceptance, whichever is longer.

T. Minimum of a 140° (±70°) horizontal viewing angle. Defined at 50% of full intensity, with automatic color-correction “on”, at stated angle maximum.

U. Minimum of a 140° (±70°) vertical viewing angle. Defined at 50% of full intensity, with automatic color- correction “on”, at stated angle maximum.

2.13 RIBBON, VOMITORY AND MARQUEE DISPLAYS – PROCESSING AND CONTROLS

A. Display control system must provide the ability to manage: brightness (multi-level), video input, image position: size and scale, adjustable gamma correction, remote power function (power on/off), color, color temperature, contrast and sharpness.

B. Processing to allow for electronic color and brightness calibration - block to block and pixel to pixel.

C. The processor shall support the following inputs: DVI video.

D. Contractor is responsible for providing all required components, racks and wiring necessary to manage and control the video display from a location outside of the display housing.

E. System architecture must allow for 100% processing and control redundancy. Back up units shall be installed in the equipment racks and shall be hot swappable.

2.14 RIBBON, VOMITORY AND MARQUEE DISPLAYS – OPERATING SYSTEM

A. Provide a fully functional operating system capable of CG, exposure time tracking, and game operation. Systems must be capable of playing back industry standard still and animation file formats. It is understood that different operating control systems have preferred file formats. File conversion is acceptable.

B. The system must be capable of accepting a serial feed from the new scoring controller and any and all 3rd party stats and sport ticker feeds, including captioning and social media as required.

C. Image playback is to be stutter-free for both static and animated graphics.

D. Operating system is to be housed in the Scoreboard Control Room.

E. Contractor is responsible for providing all required components, racks and wiring necessary to manage and control the LED display from a location outside of the display housing.

F. System architecture must allow for 100% processing and control redundancy. Back up units shall be installed in the equipment racks and shall be hot swappable.

2.15 LED DISPLAY SIGNAGE AND AESTHETICS

A. Provide and install four (4) “KFC YUM CENTER” channel cut letters on the top of the center hung displays as depicted and specified in the rendering package.

B. Provide and install underbelly signage to the center hung display as depicted and specified in the rendering package.

2.16 ANIMATION PACKAGE

A. Provide twenty (20) custom animations with a minimum of 50% 3-D animations for all new LED displays included in this package.

END OF PART 2 PRODUCTS

PART 3 EXECUTION

3.1 SCOPE OF WORK

A. The following outlines the turnkey delivery and installation responsibilities that define the project scope of work. Any and all work outlined in this section is the responsibility of the Contractor unless otherwise noted. Contractor is required to provide all labor, materials, tools, supervision, and equipment to perform the following:

1. The following outlines the turnkey delivery and installation responsibilities that define the project scope of work. All work outlined in this section is the responsibility of the Contractor unless otherwise noted. All dates referenced in this document are approximate projected dates and are subject to change.
2. Remove and dispose of all existing equipment that is being replaced in this package.
3. Contractor to provide all necessary protection for all facility components, including event floor and Arena seating. Contractor is responsible for repair or replacement of any damaged facility components caused by the Contractor and/or any subcontractors hired by Contractor to perform work on site.
4. Contractor is required to provide all labor, materials, tools, supervision, and equipment to perform the work outlined in this scope of work.
5. Provide and install all equipment and displays listed in Part 2 – Products, including any and all equipment not specifically listed that is required to provide a completely functional system.
6. Provide and install center hung LED Video Screens, signage and aesthetics as depicted and specified in rendering package. New center hung steel structure shall be engineered, supplied, and installed by Contractor. Center hung structure shall have final look and aesthetics as shown in the AJP rendering package. Maximum allowable weight of new center hung is 60,000 lbs., including any owner furnished equipment. Contractor shall provide final stamped structural drawings per Section 3.2.
7. The existing 60,000 lbs. capacity hoist shall support new center hung scoreboard. Contractor shall use or modify hoist pick points, as necessary. Contractor shall provide shackles and miscellaneous hardware to make final connection to hoist. Contractor is responsible for certifying final weight of center hung. Contractor will be responsible for all costs associated with modifications required if final weight exceeds the capacity.
8. Owner will provide sufficient primary power for the center hung on the catwalk level. Contractor shall be responsible for all electrical work from this point, including panels, breakers, conduit, wire connection, and any other electrical work required to accommodate all Contractor supplied equipment. Contractor shall provide final stamped electrical drawings per Section 3.2.
9. Provide and install Corner, Ribbon and Vomitory displays as depicted and specified in rendering package. All primary and secondary steel required shall be engineered, supplied, and installed by Contractor.
10. Owner will provide sufficient primary power all additional displays in proximate locations to the displays. Contractor shall be responsible for all electrical work from this point, including panels, breakers, conduit, wire connection, and any other electrical work required to accommodate all Contractor supplied equipment. Contractor shall provide final stamped electrical drawings per Section 3.2.
11. Owner will provide primary power and signal conduit at the marquee location. Contractor shall be responsible for foundations, primary and secondary steel, mounting brackets/hardware required for a complete freestanding marquee. The Contractor is responsible for coordinating conduit locations with the Owner prior to foundation installation.
12. Contractor to provide new signal cable to each display and may re-use existing conduit where available. Contractor responsible for installing new conduit if required due to existing conduit being damaged or not available.
13. Coordinate placement of new equipment rack(s) and electrical components.
14. Provide all required permits and licenses.
15. Provide on-site installation supervisor.
16. Deliver all Equipment to site and convey to appropriate locations within site as directed by the project.
17. Store all Equipment in a safe and secure manner until installed, or otherwise directed by the project.

3.2 ENGINEERING

A. The Contractor must submit drawings and calculations stamped by a licensed engineer in the state of Kentucky for the attachment points for any secondary steel and displays not shown on the Project Drawings.

B. Contractor is responsible for taking all seismic, wind and environmental considerations into account and making structural provisions for any such requirements.

C. Owner must approve all drawings in writing prior to the fabrication and installation of any equipment.

D. Engineered drawings are to include electrical.

3.3 STRUCTURAL CONSIDERATIONS

A. Contractor is responsible to design, engineer, build, deliver, install, integrate, and commission complete turnkey displays as specified with all required structure needed to support all display components.

B. Contractor is responsible for the provision and installation of all primary and secondary steel including but not limited to mounting brackets/hardware and cladding backup.

C. Flashing and any other related equipment shall be the responsibility of the Contractor to furnish and install.

D. Contractor is responsible for erection of all materials related to the new equipment.

E. Sub-structure is to be fabricated using structural steel and/or aluminum (optional). Contractor shall provide necessary protective separation when connecting dissimilar metals to prevent galvanic corrosion.

F. Bolted and/or field welded connections shall be subject to special inspection by an independent testing & inspection agency certifying that bolted and/or welded connections meet the minimum requirements of the engineered structural drawings, the governing building code, or as required by the building official; whichever is more restrictive. Inspections shall take place prior to painting any connection.

G. Documentation shall be provided to Owner verifying acceptable results from all special inspections. All items failing inspection shall be repaired or replaced and re-inspected at no additional cost to the Owner.

H. All components to be painted and otherwise finished for exterior service conditions shall be warranted to be free of rust or other defects for a period of ten years.

I. All welders must be certified, and certificates must be on-site and available for inspection as requested.

J. To minimize fading or oxidation, all primary structural elements must be primed and coated or galvanized.

K. Damage to paint to the structure during the installation of secondary structure, video board and signage install shall be touched up by Contractor.

3.4 ELECTRICAL AND DATA

A. The electrical design and installation of all branch circuits by the Contractor shall comply with NEC, provincial and local codes, as well as Owner regulations and guidelines.

B. Contractor shall provide remote power on/off for LED displays and signage elements. Contractor shall provide sufficient number of switches to control all displays and signage elements separately. Switches to be mounted into equipment racks along with other equipment provided by Contractor. Configuration of switches shall be submitted with shop drawings to be approved by Owner.

C. The Contractor shall provide electrical and data one-line diagrams.

D. Electrical design and engineering must be reviewed and approved by the Owner prior to any electrical work by the Contractor.

E. The Contractor will be responsible for power distribution from the demarcation points noted on the included electrical drawing. Any additional electrical components required for a complete and fully operational system but not shown on the electrical drawings shall be the responsibility of the Contractor.

F. Contractor to provide a 4” x 4” J-Box at top/bottom of each rack with power circuit cabling terminating in 24” pig tails. Label each outlet as to which AC circuit is feeding it and provide the same information in the circuit breaker panel. Owner will provide all AC power and conduit to the equipment racks and will terminate AC power circuits within the J-Boxes.

G. Contractor is responsible for all conduit and raceways as required for signal/control cable distribution. Contractor may utilize existing conduit subject to Owner approval.

H. The Contractor shall be responsible for termination and final connect of power to all displays. All secondary electrical panels must be clearly marked with names of the branch circuits controlled by each breaker to aid in troubleshooting or isolating problems. All electrical services, disconnects, and breaker panels are to be labeled with what they control and where they are fed from.

I. Contractor shall not use wire nuts or electrical tape for any power or signal connection or any part of the work including internal LED display power jumpers or power connections to signage elements. All connections shall use a proper terminal block and spade terminal or terminal block and direct connection as required. Covers shall be provided over-all high-power terminal blocks to prevent electrical shock.

J. Owners provided power to the disconnect switch shall use rigid metal conduit and wire. The use of SO cord or rubber jacket type power cables typically used on transportable installations or used on the installation of pitch side displays shall not be permit for permanent installations. Strain relief on all connectors shall be per manufactures recommendations. Contractor shall submit manufacturers strain relief recommendations for all connectors during the submittal process.

K. The Contractor will be responsible for providing stamped electrical drawings. A licensed/registered engineer in the state of Kentucky where this project is located shall stamp all electrical drawings.

L. Any equipment not certified as required in Section 1.4.A. shall require on-site certification by a listed testing agency. All cost associated with obtaining on-site certification shall be the responsibility of the Contractor. Written proof of certification or equivalent will be required prior to any work being performed on-site.

M. Multi-mode fiber tested shall not have a signal dB loss greater than 0.1dB per 100 feet (30m) for 850nm fiber or a loss greater than 0.1 dB per 300 feet (100m) for 1300nm fiber.

N. Single-mode fiber tested shall not have a signal dB loss greater than 0.1dB per 600 feet (200m) for 1310nm fiber or a loss greater than 0.1 dB per 750 feet (250m) for 1550nm fiber.

O. Contractor to provide all required fiber transmitters and receivers (including amplifiers where required). Contractor will be responsible to terminate and perform final connection of all cables. Cables will be routed from the specified control locations to the display components per Contractor's diagram once the Owner has approved diagram.

3.5 AESTHETIC CONSIDERATIONS

A. At the time of the release of this RFP the Owner is still developing certain finishes and aesthetic design elements for consideration. Contractor shall assume premium finishes on all elements not yet defined.

B. Prior to contract award, the Contractor must provide a comprehensive outline of all intended flashing and finish details for Owner approval. Failure to submit these details prior to contract award shall make Contractor responsible for all flashing and finishes as required by Owner at no additional cost to Owner.

C. No exposed bolts, inverted U channels, or unfinished edges on LED displays or signage elements shall be permitted on any surface with public view. Any part of the secondary steel frame exposed to public view shall be covered with flashing to match the edge of the LED display.

D. Unless specified differently on the AJP Drawings, the following shall serve as a minimum standard for products and finishes. Contractor shall be responsible to ensure that the material thickness provided is sufficient to prevent warping or "oil canning" on the span or sections of material installed.

1. Metals
    a. + .040" aluminum on internal baffling
    b. + .090" aluminum on flashing
    c. + .125" aluminum on any routed or primary surface
    d. + 12ga/2.6mm stainless steel (visible)
2. Plastics
    a. + .117" thickness on thermoformed polycarbonates
    b. + .177" thickness on flat polycarbonates
    c. + .125"thickness on flat acrylics
3. Finishes
    a. + Approved Automotive Grade Enamels

b. + ASTM D3451-06 compliant Powder Coating

4. Vinyl Films

a. + 3M, Avery, Oracal or other as approved.

b. + 9oz weight for any outdoor banner (UV coated)

E. The Contractor shall not visibly display its trademarks or insignia on any of the Equipment or structural elements.

3.6 TRAINING

A. The Contractor at its own expense will provide designated Owner employees' operator and maintenance training.

B. Training will be performed at the site by a qualified technician and shall occur either during installation of the equipment or immediately thereafter. O&M Manuals per Section 1.3.B shall be provided to Owner prior to training.

C. The training shall cover the operation, routine maintenance and troubleshooting of the displays and control equipment.

D. Training shall consist of at least 24 hours (over the course of 3-5 days) of instruction.

E. Contractor will be required to have a control systems operator and LED technician on-site for the first event and continue to be on-site for three (3) consecutive problem free events. "Problem-free" constitutes an event where the video and scoring displays, control system, and any other components installed by the Contractor are without failure during an event. Each successful event will need to be signed off by the Owner until three (3) consecutive events are achieved.

F. Warranty period will commence at conclusion of the third consecutive successful event.

3.7 TESTING AND ACCEPTANCE

A. Contractor must demonstrate the full capabilities of the provided systems and prove performance meets contractual specifications.

B. Confirmation will be required of, but not limited to the following functions: operation of each system component, including back-up systems, control functionality, integration with existing systems, diagnostic capabilities, screen brightness, color temperature and viewing angles.

C. Contractor must provide all necessary testing equipment for acceptance.

D. Upon notice from the Contractor of substantial completion and at a time to be mutually agreed upon, the Contractor will arrange for the testing of all operations of the systems comprised in scope of work at the time of substantial completion.

E. The following items must be completed and signed off by an appropriate Owner official before the Owner will deem the system "Accepted"

1. LED Screens - Brightness and color uniformity shall be demonstrated and must meet the specification described. If the demonstration exhibits the display in noncompliance with the specifications, it will be the responsibility of the Contractor to make the necessary adjustments or to adjust, repair or replace the components necessary to meet the specifications. The Owner will not be responsible for any added costs as a result of an unsuccessful acceptance test.

2. Certain LED video displays included in this RFP are required to maintain minimum parameters over a specified period of time. The Owner at its sole discretion may engage an independent testing agency to verify the display's specifications, at any time during the specified period of time. Cost for this testing will borne by the Owner if display is complying. If the testing exhibits the display in noncompliance with the specifications, the cost of the testing will be the responsibility of the Contractor. Contractor will also be responsible to make the necessary adjustments or repair or replace the components necessary to meet the specifications. The Owner will not be responsible for any added costs as a result of an unsuccessful test.

3. Functionality of each of the displays and their control systems, as specified, shall be demonstrated in its entirety.

4. Acceptance of the system includes, but not limited to, the completed installation of all physical components and the issuance of the Certificate of Approval for code compliance by the Code Authority

having Jurisdiction. Tests of the system shall not occur until after the system has been installed, and all work completed on the display systems.

F. Document all acceptance testing, calibration and correction procedures described herein. Include the following information:

1. Performance date of the given procedure.
2. Condition of performance of procedure.
3. Type of procedure, and description.
4. Parameters measured and their values, including values measured prior to calibration or correction, as applicable.
5. The names of personnel conducting the procedure.
6. The equipment used to conduct the procedure.

G. Upon completion of initial tests and adjustments, submit written report of tests to the Owner along with all documents, diagrams, and recorded drawings required herein.

H. Final Procedures

1. Perform any and all “punch-list” work to correct inadequate performance or unacceptable conditions, as determined by the Owner, at no additional expense to the Owner.
2. Furnish all portable (includes spare parts) equipment to the Owner along with complete inventory documentation. All portable equipment shall be presented in the original manufacturers packing, complete with all included instructions, miscellaneous manuals, and additional documents.
3. Provide new acceptance testing in the same format as initial test reports.
4. Check, inspect, and if necessary, adjust all systems, equipment, devices, and components specified, at the Owner’s convenience, approximately thirty (30) days after the Owners acceptance.
5. Upon completion of the Work, the Owner may elect to verify test data as part of acceptance procedure. Provide personnel and equipment, at the convenience of the Owner, to reasonably demonstrate system performance and to assist with such tests without additional cost to the Owner.

END OF PART 3 EXECUTION